

1. There is a gene for sleepwalking. A father who is always sleepwalking has children with a mother who is sometimes sleepwalking and other times she doesn't sleepwalk. After many years they have many children expressing the percentages of the phenotypes shown below.

25% females that <u>sometimes sleepwalk and other times never do</u> $X^S X^N$	25% females that are <u>always sleepwalking</u> $X^S X^S$	25% males that are <u>never sleepwalking</u> $X^N Y$	25% males that are <u>always sleepwalking</u> $X^S Y$
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a. **Construct** a Punnett square that shows what the genotypes of the parents & children are.

b. **Identify & explain** the type(s) of inheritance pattern(s) shown

- Males & Females affected differently = X-linked
- Mom shows both phenotypes = codominance

	$X^S$	$X^N$
$X^S$	$X^S X^S$	$X^S X^N$
$X^N$	$X^S X^N$	$X^N X^N$
$Y$	$X^S Y$	$X^N Y$

2. A dihybrid purple bodied, spiny snake x double recessive white body, smooth snake (testcross) produced the offspring in the table below.

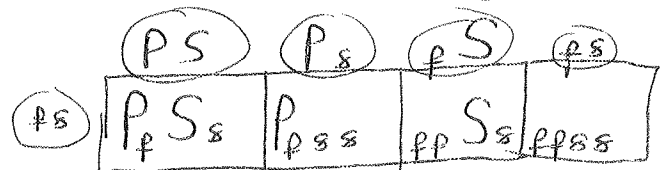
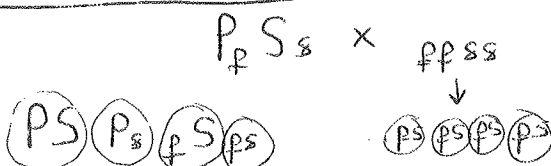
a. Calculate the distance between these 2 genes

b. Calculate the Chi square value for the hypothesis that these two genes assort independently.

731 Purple, Spiny	698 White, Smooth	62 Purple, Smooth	53 White, Spiny
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$$\frac{62 + 53}{1544} = 7.4 \text{ map units}$$

observed # offsprings



Expected percentages

25%	25%	25%	25%
↓	↓	↓	↓
Expected # offsprings			
386	386	386	386

$$\frac{(o-e)^2}{e}$$

$$\text{Total offspring} = 1544$$

Purple Spiny	308
White Smooth	252
Purple Smooth	272
White Spiny	287

$$\sum = 1,119 = \chi^2 > \text{c.v.} = \text{Reject N.H.} \dots \text{genes DON'T assort independently, they are linked!}$$

3. Two genes are linked and located 31 m.u. apart. If there were 1104 parental type offspring from a dihybrid x double recessive (testcross), what was the total number of offspring from the testcross?

$$.31 = \frac{r}{1104 + r} \rightarrow 342 + .31r = r$$

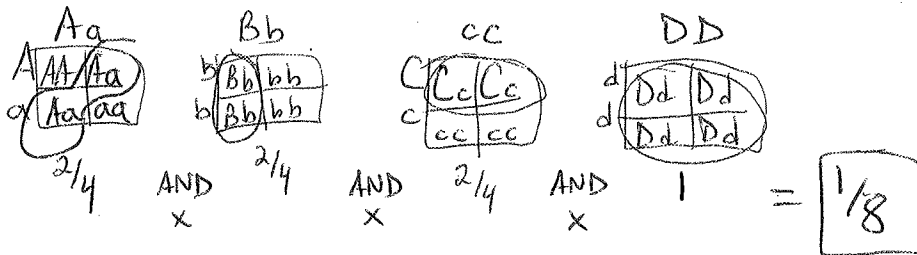
$$342 = 0.69r$$

$$r = \frac{342}{0.69} = 496$$

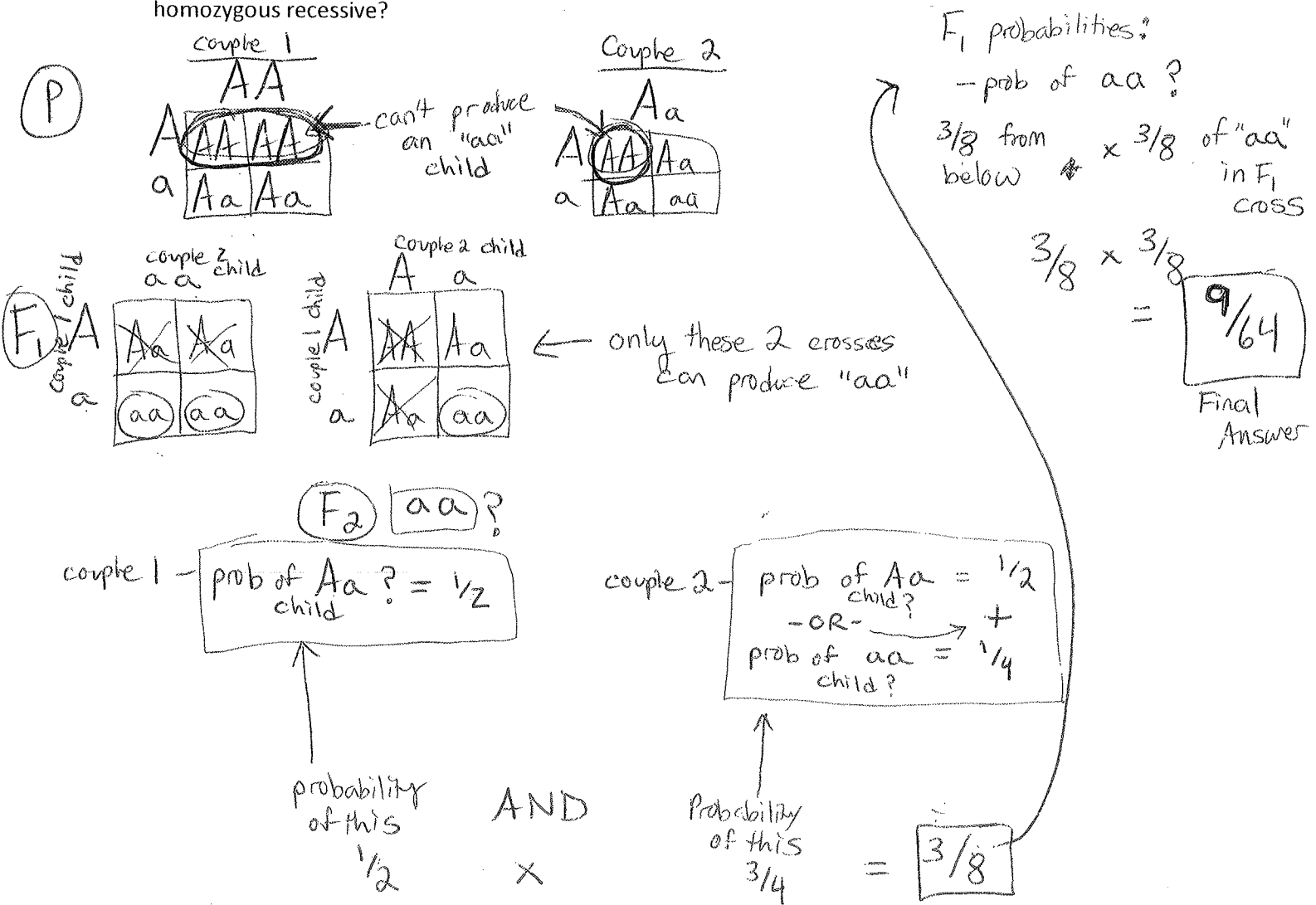
total offspring = 496 + 1104 = 1600

4. 4 Genes, ABCD, control 4 different traits in an organism & are unlinked genes. For the cross below, what is the probability that the offspring will be heterozygous for all 4 traits?

AaBbccDD x AabbCcdd

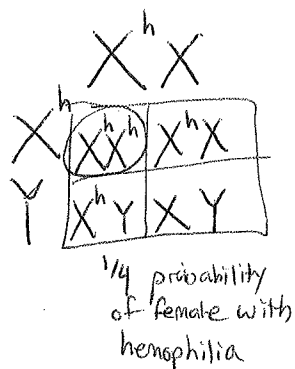
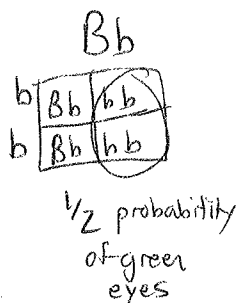


5. 1 couple consisting of a homozygous dominant individual & a heterozygous individual have children. A second couple, both heterozygous, also has children. Assume that a child from couple 1 and a child from couple 2 eventually have children together. What is the probability of their child being homozygous recessive?



6. A woman (heterozygous for brown eyes & a carrier for hemophilia) and a man (with green eyes & hemophilia) have children. Assuming that hemophilia is X-linked recessive & green eye color is autosomal recessive, what is the probability of them having a green-eyed female child with hemophilia?

$$BbX^hX \times bbX^hY$$



$$\frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$$

green eyes female hemophilia

$\frac{1}{8}$  of a green-eyed female child with hemophilia.

7. Hair color in humans is controlled by 2 genes: B for tone of color & M for amount of color. BBMM, BbMM or BBmm is black; bbMM or bbMm is light brown; BBmm or Bbmm is dark brown; bbmm is blonde. Write the possible & impossible phenotypes for each cross.

a. light brown x light brown  $bbM\_ \times bbM\_$

$bbMm$  or  $BbMM$  for all offspring = Light Brown

All other colors impossible

b. blonde x black  $bbmm \times B\_M\_$

$BbMm$  = black  
 $bbmm$  = blonde  
 $Bbmm$  = dark brown

$bbMm$  = light brown

All possible offspring

c. light brown x blonde  $bbM\_ \times bbmm$

$bbMm$  = light brown  
 $bbmm$  = blonde

All other colors impossible

d. Dark brown x blonde  $B\_mm \times bbmm$

$Bbmm$  = dark brown  
 $bbmm$  = blonde

All other colors impossible